

CEMP-RT

DEPARTMENT OF THE ARMY
U.S. Army Corps of Engineers
Washington, DC 20314-1000

EM 200-1-4

Manual
No. 200-1 -4

30 June 1996

Environmental Quality
RISK ASSESSMENT HANDBOOK,
VOLUME II: ENVIRONMENTAL EVALUATION

Table of Contents

Subject	Paragraph	Page	Subject	Paragraph	Page
Chapter 1			Risk Assessment as Decision		
Introduction			Criteria in the HTRW Program . .	1.4.2	1-12
Purpose and Scope	1.1	1-1	Policy Considerations and		
Objectives	1.1.1	1-1	Risk Management	1.5	1-12
Scope	1.1.2	1-1	Relationship Between Policy		
Intended Audience and Use	1.1.3	1-2	Considerations and Risk	1.5.1	1-13
Contents of the Manual	1.1.4	1-2	EPA Headquarters, Regional, and		
USACE Role in the HTRW			State Policies	1.5.2	1-13
Program	1.2	1-3	Risk-Based Management Decisions		
DERP	1.2.1	1-3	for Site Actions	1.5.3	1-13
BRAC	1.2.2	1-3	Regulatory Directives and		
Others	1.2.3	1-3	Guidance	1.6	1-13
HTRW Program Organization	1.2.4	1-4	Executive Orders and Federal		
Overview of HTRW Response			Statutes/Regulations	1.6.1	1-14
Process	1.3	1-4	DoD Directives	1.6.2	1-15
CERCLA Process	1.3.1	1-4	EPA Headquarters and Regional		
RCRA Corrective Action			Guidance	1.6.3	1-15
Process	1.3.2	1-6	State Requirements/Guidance	1.6.4	1-17
Functional Equivalency of			Others	1.6.5	1-17
CERCLA and RCRA Corrective			Federal Facility Agreement	1.7	1-19
Action Processes	1.3.3	1-7	Basis for Interim Remedial Action		
Role of Risk Assessment in the			(IRA) Alternatives	1.7.1	1-20
HTRW Process	1.3.4	1-7	Requirements for RI/RFI and		
Concept of Risk Assessment and			FS/CMS	1.7.2	1-20
Good Science	1.4	1-9	Expedited Cleanup Process	1.7.3	1-20
Basic Concepts	1.4.1	1-10	Units Excluded from the		
			Agreement	1.7.4	1-20

Subject	Paragraph	Page	Subject	Paragraph	Page
Chapter 2					
Ecological Risk Assessment					
Scoping Considerations					
Introduction	2.1	2-1	Ecological Site Description	4.2.1	4-4
Scoping Considerations	2.2	2-2	Chemical Data Collection and Review	4.2.2	4-5
Objectives of the Ecological Risk Assessment	2.2.1	2-2	Selection of Preliminary Chemicals of Ecological Concern	4.2.3	4-15
Definition of Ecological Risk Assessment	2.2.2	2-2	Selection of Key Receptors	4.2.4	4-25
Planning for an ERA	2.2.3	2-3	Ecological Endpoints Identification	4.2.5	4-32
HTRW Policy and Technical Project Planning	2.2.4	2-7	Ecological Conceptual Site Model	4.2.6	4-34
The HTRW Technical Project Planning Process	2.2.5	2-7			
Approaches to the Conduct of an ERA	2.2.6	2-10	Analysis Phase - Exposure Characterization	4.3	4-37
Establishing the Level of Effort	2.2.7	2-11	Exposure Setting Characterization	4.3.1	4-39
			Exposure Analysis	4.3.2	4-39
Introduction to the ERA Process	2.3	2-11	Exposure Profiles	4.3.3	4-45
Introduction to the Four-Tiered Approach	2.4	2-13	Analysis Phase - Ecological Effects Characterization	4.4	4-54
			Objectives	4.4.1	4-54
Chapter 3			Sources of Literature Benchmark Values	4.4.2	4-54
Evaluating the Screening Ecological Risk Assessment			Selection of Literature Benchmark Values	4.4.3	4-55
Introduction	3.1	3-1	Development of Reference Toxicity Values	4.4.4	4-56
Problem Formulation	3.2	3-1	Additional Considerations in Developing RTVs	4.4.5	4-62
			Special Chemicals	4.4.6	4-64
Chemical Data Collection and Review	3.2.1	3-1	Risk Characterization	4.5	4-69
Ecological Conceptual Site Model	3.2.2	3-1	Risk Estimation	4.5.1	4-69
Problem Formulation Summary	3.2.3	3-2	Characterization of Uncertainty	4.5.2	4-73
			Risk Description	4.5.3	4-77
Exposure and Effects Analysis	3.3	3-2			
Exposure Characterization	3.3.1	3-2	Chapter 5		
Effects Characterization	3.3.2	3-3	Evaluating the Tier II Baseline Ecological Risk Assessment		
			Introduction	5.1	5-1
Preliminary Risk and Uncertainty Characterization	3.4	3-3	Problem Formulation	5.2	5-3
Chapter 4			Field Studies	5.2.1	5-6
Evaluating the Tier I Baseline Ecological Risk Assessment			Laboratory Studies	5.2.2	5-7
Introduction	4.1	4-1			
Problem Formulation	4.2	4-4	Data Collection and Analysis	5.3	5-7
			Revision of the Tier I ERA	5.4	5-7

Subject	Paragraph	Page	Subject	Paragraph	Page
Chapter 6			Determining Requirements		
Evaluating the Tier iii Baseline			for Action	9.2	9-5
Ecological Risk Assessment			PA/SI and RFA	9.2.1	9-5
Introduction	6.1	6-1	RI/RFI	9.2.2	9-12
Problem Formulation	6.2	6-1	FS/CMS and RD/RA	9.2.3	9-15
Field Studies	6.2.1	6-2	Nonrisk Issues or Criteria as		
Modeling Studies	6.2.2	6-2	Determining Factors		
Laboratory Studies	6.2.3	6-2	for Actions	9.2.4	9-20
Data Collection and Analysis	6.3	6-2	Design Considerations	9.3	9-22
Revision of the Tier II ERA	6.4	6-2	Potential Risk Mitigation		
Chapter 7			Measures	9.3.1	9-22
Evaluating the Tier IV Baseline			Risk Management; Degree of		
Ecological Risk Assessment			Protectiveness	9.3.2	9-23
Introduction	7.1	7-1	Glossary		
Problem Formulation	7.2	7-1	Exhibits		
Field Studies	7.2.1	7-1	Appendix A		
Ecosystem Modeling Studies	7.2.2	7-1	References		
Laboratory Analysis	7.2.3	7-2	Appendix B		
Data Collection and Analysis	7.3	7-2	information Sources for		
Revision of the Tier III ERA	7.4	7-2	Ecological Risk		
Chapter 8			Assessment		
Evaluating the Ecological Risk			Appendix C		
Assessment of Remedial			Framework		
Alternatives			Appendix D		
Introduction	8.1	8-1	HTRW Technical Project		
Development of Remediation			Planning Process		
Levels	8.2	8-1	Appendix E		
Comparative Risk Assessment of			Monte Carlo Analysis		
Remedial Alternatives	8.3	8-2	Appendix F		
Other Applications of Ecological			Ecotoxicity Profiles for		
Risk Assessments	8.4	8-3	Munitions Compounds		
Chapter 9			Appendix G		
Risk Management -- information			Benchmark Studies		
Needed for Decision-Making					
Introduction	9.1	9-1			

List of Tables

Table		Page	Table		Page
4-1	Chemicals of Ecological Concern According to Final Water Quality Guidance for the Great Lakes System	4-26	5-3	Ecological Risk Assessment Approaches, Techniques, and Endpoints Used to Characterize Actual Risk	5-5
4-2	List of Environmental Laws and Ecological Receptors	4-30	5-4	Ecological Attributes	5-6
5-1	Comparison of Methods for Assessing Sediment Quality	5-3	9-1	The Potential Use of Risk Assessment Concepts/Procedures as a Risk Management Tool	9-6
5-2	Ecological Risk Assessment Approaches, Techniques, and Endpoints Used to Characterize Potential Risk	5-4			

List of Figures

Figure		Page	Figure		Page
1-1	Comparison of RCRA and CERCLA processes	1-8	9-2	HTRW risk management decision-making process flow diagram	9-2
2-1	ERA flow chart	2-5			
2-2	Baseline ERA flow chart	2-6	9-3	HTRW paradigm for risk management decision-making	9-4
4-1	Site-wide exposure matrix	4-80			
4-2	SWMU-specific exposure matrix	4-81	9-4	Flow diagram of relative risk site evaluation framework	9-8
5-1	Interrelationship of tiers: Sediment quality assessment	5-2			
9-1	Inputs for risk management decision-making, HTRW project decision diagram	9-1			

List of Case Studies

Case Study	Page	Case Study	Page
1 Site Setting	4-2	8 Example of Applying a Statistical	
2 Development of a Preliminary		Test to Determine Comparability	
Ecological Conceptual		with Background	4-22
Site Model	4-7	9 Exposure Characterization	
3 Diagramming the ECSM	4-8	(Terrestrial Ecosystem)	4-35
4 Development of a Sampling		10 Distributional Analysis	4-38
and Analysis Plan	4-12	11 Calculation of Exposure Point	
5 Sampling Results (Terrestrial		Concentrations (Terrestrial	
Ecosystem)	4-14	Ecosystem)	4-47
6 Selection of COECS - I		12 Derivation of a Small Mammal	
(Terrestrial Ecosystem)	4-18	RTV for Acetone	4-60
7 Selection of COECS - II			
(Terrestrial Ecosystem)	4-19		

List of Exhibits

Exhibit	Page	Exhibit	Page
1 Examples of Minimum Requirements		14 Calculation of the 95% Upper	
for Ecological Risk Assessments	EX-2	Confidence Limit	EX-21
2 Factors to Consider When Reviewing		15 Allometric Equations for	
Data for the ERA	EX-4	Determining Wildlife Feeding	
3 Methods for Identifying		and Drinking Rates	EX-22
Appropriate Quantitation Limits	EX-5	16 General Factors to Consider	
4 Data Quality Indicators	EX-7	When Selecting Exposure Factors	EX-24
5 Importance of Data Quality Review		17 Toxicity Equivalency Factors (TEFs)	
in an ERA	EX-8	for Polychlorinated Dibenzo-p-Dioxins	
6 Chemicals to Examine for Background		(PCDDs) and Dibenzofurans	
Presence	EX-10	(PCDFs)	EX-25
7 Reference Toxicity Values for		18 Tiered Approach to Assessment of	
Aquatic Ecosystems	EX-11	Sediment Quality and Characterization	
8 Legal Perspective - Protection of the		of Risk to Aquatic Life	EX-26
Individual Versus the Population in		19 An Example of Development of	
the Endangered Species Act and		Remediation Levels for	
Migratory Bird Treaty Act	EX-13	Terrestrial Receptors	EX-29
9 Components of the Ecological		20 Development of Remediation Goals for	
Conceptual Site Model	EX-15	Aquatic-Based Wildlife Receptors	EX-31
10 Chemical and Physical Properties and		21 A Case Example Study for Risk	
Their Role in Fate and Transport	EX-17	Assessment in Removal Action	
11 Determination of Current and Future		Decision-Making	EX-32
Land Use	EX-18	22 A Case Example Study for	
12 Potential Exposure Pathways and		Screening Risk Analyses of	
Routes	EX-19	Residual Risks FS or CMS	
13 General Factors to Consider When		Risk Management Decision-Making	EX-33
Deriving Exposure Point			
Concentrations	EX-20		